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Vulnerability, Resilience and Transformation of Urban Areas in the Coastal Megacity Lagos: Findings of Local Assessments and a Household Survey in Highly Exposed Areas

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Coastal urban regions in low-lying areas in developing countries are often hotspots of climate change related risks and therefore the analysis of different characteristics of vulnerability, resilience and transformation is an important prerequisite for planning and decision making. Even though the concepts of resilience and transformation have been discussed for some time, they often remain still very abstract. Against this background the following paper aims to illustrate how different characteristics of vulnerability: susceptibility, exposure and adaptation from resilience to transformative change can be assessed in practice at the level of individual households and different city districts. The household survey was conducted in four low-income, at risk areas in the coastal megacity of Lagos. It reveals important differences between the case study locations in

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terms of perceived capacities and actual responses of households to extreme events and creeping hazards. The analysis of behavioral changes undertaken after extreme events underscores that experience of loss and damage is an important stimulus for people to change their behavior. Moreover perception of actual and future risk management capacities and the performance of government institutions influences risk management regimes at the household level. It was found that at risk populations experienced both, inaction from government and individual households. This is a corrective to the majority literature that focuses on proactive local or government action. In fact, these examples of success may be quite rare and were not found in the four settlements studied in this research. The survey is part of a larger international project regarding the Transformation and Resilience of Urban Coasts (TRUC (2016). Transformation fo urban coasts Available at www.bel_truc.org) funded by the Belmont Forum and the DFG in particular in terms of the research in Lagos.

Keywords: Vulnerability; Resilience; Transformation; Lagos; Megacities; Household survey.

1. Introduction

Lagos is one of the coastal megacities in Africa, a major economic center that is growing rapidly in urban population. However, at the same time many migrants and people with low income face precarious housing conditions and often have to live in informal settlements with insufficient access to basic infrastructure services and limited political power (see e.g., [Oyesol 2012](#)). In addition, sea-level rise and extreme weather events (particularly heat stress and heavy precipitation) are likely to intensify in various regions due to climate change (see [IPCC 2014](#)). In this context, the megacity of Lagos is one of the core research areas of the Transformation and Resilience in Urban Coasts (TRUC) project (see [TRUC 2016](#)). Next to Lagos the household level assessments of vulnerability and transformation have also been conducted in New York and Kolkata. A comparative vulnerability assessment of all TRUC cities — namely New York, London, Tokyo, Kolkata and Lagos — can be found in [Welle and Birkmann 2016](#). The survey and assessment below complements previous studies regarding the dynamics of resilience and vulnerability to climate change in coastal megacities (see e.g., [Simonovic and Peck \(2013\)](#)).

1.1. Lagos State and Lagos Metropolitan Area

Lagos State is located on the south-western part of Nigeria and bounded on the north and east by Ogun State. Lagos State with a population of about 20–23 million ([Lagos State Bureau of Statistics and Research 2013](#); [UN 2014](#); [Adelekan 2014](#); [Adelekan and Asiyanbi 2016](#)), is the commercial and industrial hub of Nigeria, and an important economic center in West Africa. Lagos State accounts for 60 % of Nigeria's Gross Domestic Product and 65 % of national investments ([Lagos Bureau of Statistics 2013](#); [Adelekan 2010, 2015](#)). The Lagos Metropolitan

area consists of two main areas, namely Lagos Island and Mainland. While Lagos Metropolitan area is covering solely 37% of the land area of Lagos State, it is home to over 85% of the population (see also Figure 1). The city of Lagos grew in the last 60 years enormously. In 1952, the population was about 345,000 people and grew to 1,142,242 people in 1963. In 1988, the city encompassed already 5.32 million people and grew to a megacity within 20 years. In 2006, the National Bureau of Statistics estimated the population size of Lagos city with about 9,113,605 people. At present the UN World Urbanization Prospect estimates the population size of Lagos city in 2015 with about 13 million people (UN 2014).

In many locations of Lagos, the urbanization process itself is characterized by informality that means building codes, zoning regulations or strategic planning are often absent or bypassed (Oyesiku 2011). Larger informal settlements and slum areas in highly sea-level rise or flood prone areas are one outcome of this development. In these areas most inhabitants have solely limited access to basic infrastructures and lack resources to get out of chronic poverty. Specific challenges also relate to the features of the state and the Metropolitan area of Lagos such as continued rapid urbanization processes (urban population growth) within the context of a flat topography (see e.g., Braimoh and Onishi 2007; Filani 2012). For example, Lagos Island is less than 0.15 m above sea-level and therefore highly exposed to potential coastal flooding and sea-level rise. Recent climate change effects and natural hazards have increased beach erosions and flooding of buildings in low-lying coastal areas. Interruptions of important basic

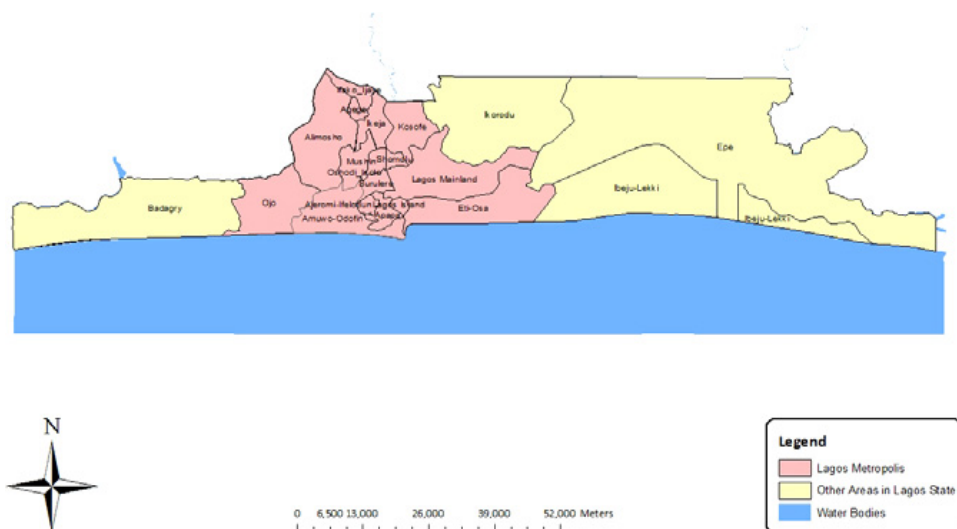


Figure 1. Map of Lagos State and the Local Government Areas (LGAs)

infrastructure services, including water and drainage networks are some of the consequences. In 1995 and 2010, 2011 and 2012 the city experienced major floods and adverse events. This means that Lagos is a particularly interesting laboratory to examine, assess and monitor aspects and dynamics of vulnerability, resilience and transformation. In this regard, the household survey did not solely focus on characteristics of personal or household vulnerability, but at the same time investigated the perceived capacities of households to deal with natural hazards as well as changes in risk management strategies and urban transformation processes. This information is essential for policy processes and decision makers that aim to strengthen urban resilience and to promote positive transformative change.

1.2. Background: Policy responses to address urban poverty and extreme events

As part of its urban renewal efforts, the Lagos State Government (LSG) in 2008 put in place a new vehicle to upgrade 10 communities in order to improve liveability in Lagos. This included slum upgrading projects in the Mushin, Itire and Ijeshatedo communities. The projects encompassed the upgrading of 30 roads and drains, provision of boreholes as well as upgrading of primary schools. The upgrading sub-projects were developed in response to the expressed demand of the beneficiaries in slums — namely Agege, Orile Agege, Ajegunle, Amukoko, Badia, Iwaya, Makoko, Ilaje, Bariga and Ijeshatedo/Itire. The areas selected were based on a larger survey conducted in 1995 regarding the living conditions in slum communities in Lagos State. In addition LSG's activities in addressing environmental change issues including climate change in the last five years have included the establishment of a Climate Change Unit.

Against this background and based on research on vulnerability and resilience of urban areas in general (see e.g., Birkmann 2013; Birkmann *et al.* 2016) and in Lagos in particular (see Ajibade and McBean 2014; Ajibade *et al.* 2013, 2014) as well as conceptual work on transformation (Solecki *et al.* 2017) we examine how local households in Lagos perceive different hazards, vulnerabilities and risk management options and actual activities from the past and their potential performance in the future. Aspects of vulnerability, resistance, resilience and transformation are examined through the perspective of households living in highly exposed areas in Lagos. Consequently, the study focuses on household level vulnerability and risk profiles as well as household level risk management regimes and evaluations about the performance of governmental risk management at local scale. The survey is comparable with similar household surveys conducted within

the TRUC project in Kolkata and New York. In particular the household survey examined the following seven questions:

1. How do different households perceive their susceptibilities and capacities to deal with extreme and adverse events in exposed locations in Lagos?
2. Do people feel prepared regarding present and future risks linked to natural hazards and climate change?
3. How do households view their own risk management performance in the past?
4. Did households change their risk management strategies and behavior after extreme events?
5. Why did households change their risk management and behavior after an extreme event?
6. How do households evaluate risk management actions of local authorities in the past?
7. Do households assume that the performance of local governmental institutions and their risk management will improve or decrease in the future (next 10 years) in terms of supporting households at risk?

The study contributes to emerging discussions on the adaptation-development nexus that is interested in the positioning of disaster risk management (DRM) and development. Solecki *et al.* (2016) identify four possible relationships: resistance (the aim of DRM is to protect existing development gains from risk); resilience (the aim of DRM is to work with development to facilitate learning and flexibility, to protect core functions); transformation (development is a cause of risk and adjusting development is the best way to achieve RM); collapse (there is no strategic capacity for orienting DRM). Development is understood to include existing land-use, established practices of work, governance and administrative arrangements and technologies. Development is contested and judgement on the adaptation-development nexus will be contingent on viewpoint (policy orientation, scale and value-position of stakeholders). The household survey presented in this paper contributes to giving voice to populations which are at risk.

The household level survey complements an assessment of vulnerability and risk at the local level conducted coastal megacities of the TRUC project, namely Kolkata, New York, Tokyo and London (see [Welle and Birkmann 2016](#)). While the comparative vulnerability assessment of these cities is based on official statistical data and therefore captures primarily broader issues of susceptibility, coping and adaptation capacities of people or institutions for an entire city, the household survey allows to explore individual changes in risk management regimes at household level. In addition, the household survey explores more in-depth how individual households judge their own situation and risk management context.

Thus, the survey provides important information about shifts and changes in risk management practices and regimes and how risk perceptions and past experiences influence these changes.

Overall, the analysis of vulnerability, resilience and transformative change at the household level allows us to deepen the knowledge on how people exposed react and modify their risk management in order to deal with their vulnerabilities as well as past and future adverse events linked to natural hazards and climate change. In this regard, [Yang et al. \(2015\)](#) underscore that risk perception and knowledge have an important impact on individuals' behavior and risk management approaches. In this regard, the paper presents new findings on if and how people in Lagos changed their behavior and risk perceptions after extreme events and in the context of potential future changes due to climate and socio-economic trends. We investigated behavioral patterns of households before, during and after extreme events (floods and heatwaves) and also captured their own evaluation of resources and deficiencies in the context of dealing with extreme events and natural hazards. The data gathered through the household interviews can help to better understand communities' adaptation processes and adaptation barriers toward risks in coastal megacities. Furthermore, the information obtained for selected sites in Lagos, for example the perception about the residential safety, environmental and housing conditions as well as the importance of different natural hazards, can inform strategic development approaches in urban planning and local DRM. In addition, local DRM approaches might utilize the information about behavior changes and the different stimuli that fostered these changes in their own programmes. Finally, the evaluation of actions of local risk reduction measures by the households exposed can be an important information source for improving and strengthening respective programmes for individual districts. That means the information gathered through the household survey can in part provide feedback and also function as a monitoring tool that should inform future actions.

2. Methodology and Case Study Selection

The following section explains more in-depth the methodology used within the household survey and the case study selection.

2.1. Case study selection

For the household (HH) survey four LGAs out of 20 total LGAs in Lagos State were selected, namely Lagos Mainland, Badagary, Ajeromi-Ifelodun and Shomolu. These areas are highly exposed to inland and potential coastal flooding on one hand and mostly encompass low income households with different livelihood

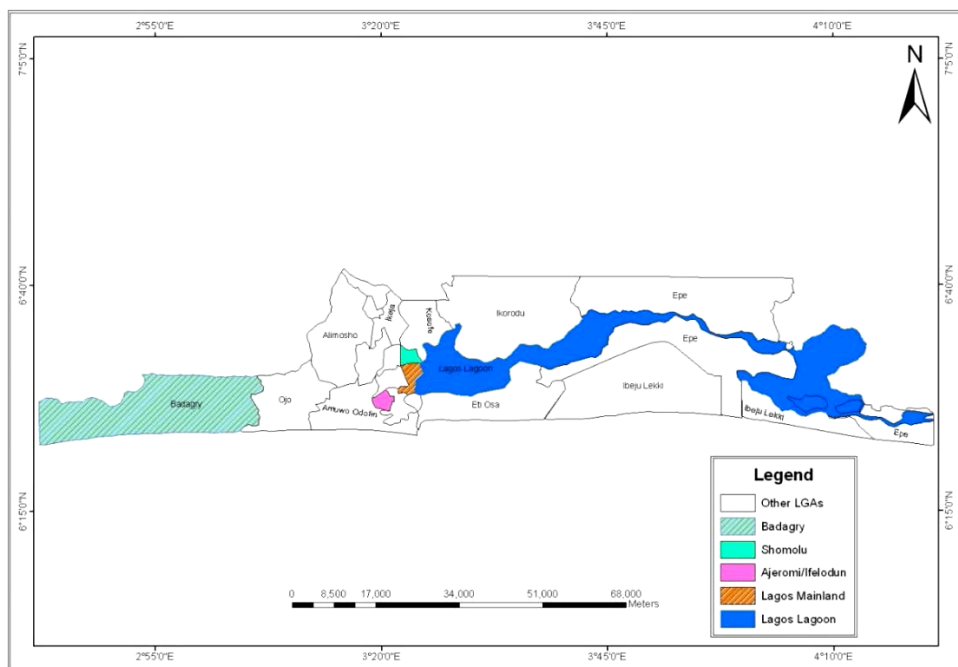


Figure 2. Household Survey Study Locations (LGAs) in Lagos, Nigeria

profiles. The case study sites also represent different types of urban areas in terms of density and closeness to the city center versus city fringe. An overview of the study location is presented in Figure 2 and Table 1 provides a short outline of the general household profile.

Table 1. Profile of Households in the Four Selected Survey Locations in Lagos

Profiles/LGAs	Badagary	Shomolu	Lagos Mainland	Ajeromi-Ifelodun
Population	505,104	1,361,110	835,779	1,905,717
Population Density	1,140 people/sq km	93,227 people/sq km	42,598 people/sq km	137,102 people/sq km
Land area	6,258.4 Ha	1,145.7 Ha	1,930.6 Ha	4,767.66 Ha
Neighborhoods studied	Badagry town (low income) Aradagun (low income)	Ilaje (low/middle income) Shomolu (low nad middle income) Bariga (low/middle income)	Ebute-meta (middle income) Makoko (low income) Iwaya/Onike (middle income)	Ajegunle (low income) Boundary (low income)

2.2. Sampling framework

The survey research adopted systematic sampling techniques. Lagos city was clustered into four LGAs with each cluster having three and/or two strata, namely, Badagary (Badagary town, Aradagun and Ibereko area), Shomolu (Shomolu, Ilaje, Bariga), Lagos Mainland (Ebute Metta, Makoko and Iwaya/Onike) and Ajeromi-Ifelodun (Ajegunle, Boundary). Badagary cluster is a low-density city fringe area with low income residents. The second cluster, Shomolu, is closest to the city center area of middle and low-income residents while the Lagos Mainland cluster houses residents of middle and low income earnings. The fourth cluster, Ajeromi-Ifelodun, is classified as low income area.

A random sampling method was used to select the individual households. Interview teams were selected every third house to conduct an interview. In case of the absence or unwillingness of a household to participate in the survey the next household was selected. In general, the head of a household was interviewed and in the case that the head of household was not available, elderly occupants or spouses were asked to be interviewed. The household survey captured about 600 households with an interview duration between 40 and 50 min per household.

The questionnaire encompassed four core areas, (1) personal information and household profile, (2) evaluation of the importance of different natural hazards, (3) the household's living conditions (proxies for vulnerabilities and capacities) and (4) risk management strategies of the individual household and the evaluation of the local risk management performance (see in detail household survey questionnaire on IREUS website <http://www.unistuttgart.de/ireus/forschung/forschungsprojekte/laufende/truc/index.html>). In order to derive a more in-depth information base for assessing different aspects of vulnerability, the household survey encompassed, next to aspects of income and education (see also Welle and Birkmann 2016), also issues of health, nutrition, housing and safety as well as environmental qualities. These factors that have not been sufficiently captured so far in official statistical data have been gathered within the interviews using a self-evaluation and ranking methodology, including statistical validation processes.

3. Selected Findings of the Household Survey in Lagos

The following section presents analysis of vulnerability and capacities regarding the different case study locations investigated. In addition, we explored which households changed their behavior after an extreme event. The statistical analysis based upon assessment of variance (ANOVA) to test the differences between two or more means in order to evaluate and compare the statistical mean values. Thereafter, the significance of all possible contrasts among the means were

calculated (not only the pairwise differences) based on the Scheffe-Test (see e.g., Norris *et al.* 2013).

3.1. Susceptibility

Each household was asked to indicate their level of satisfaction with health, nutrition and housing conditions. Significant deficits and problems of households in terms of health and nutrition as well as in terms of safe and adequate housing can be seen as proxies for vulnerability (see e.g., UN-HABITAT 2009; Welle and Birkmann 2015; Birkmann and Welle 2016). Household status on these measures is an outcome of past developments and shocks, coping and adaptive capacity and indicates the extent to which households in each sample area are able to withstand stress or shock. Respondents were asked to classify input indicators between 10 (excellent capacity) and 0 (no capacity). For example, 10 meant that the household viewed its health status or housing quality as excellent, while low values indicated clear deficiencies. Also in terms of housing quality, the value zero indicates precarious housing conditions with no sanitation and no fresh water and little space, while 10 means that housing conditions are very good or excellent. Similar judgements and evaluations were conducted in terms of the safety and the environmental conditions of the residential area. The findings, aggregated for each sample site are shown in Figure 3.

Comparing values across study sites housing (3) and environmental conditions (2) are perceived to be most problematic. The overall low values in terms of housing and environmental conditions indicate that problems linked to natural hazards, such as flooding, might lead to further risk accumulation and cascading effects. For example contaminated water bodies and insufficient sewage infrastructure as part of the problematic environmental conditions might lead to the spreading of diseases once a flood or waterlogging occurs within the area. In contrast respondents from all neighborhoods perceive the least troubling aspects of susceptibility to be health and nutrition. This may reflect the more immediate compounding influence on risk of housing and environmental conditions. Residential safety is a proxy of social capital and will vary greatly by individual (women will perceive safety differently from men), here respondents were overwhelmingly male heads of household. Residential safety had the greatest variance of any indicator.

Aggregating values for each neighborhood indicates that the highest susceptibility can be found in Ajeromi-Ifelodun with an overall score of 4.25 followed by Shomolu with 5.07 and Badagary 5.55. Lagos Mainland returns an aggregate score of 5.61 indicating a significantly lower susceptibility level compared to the other

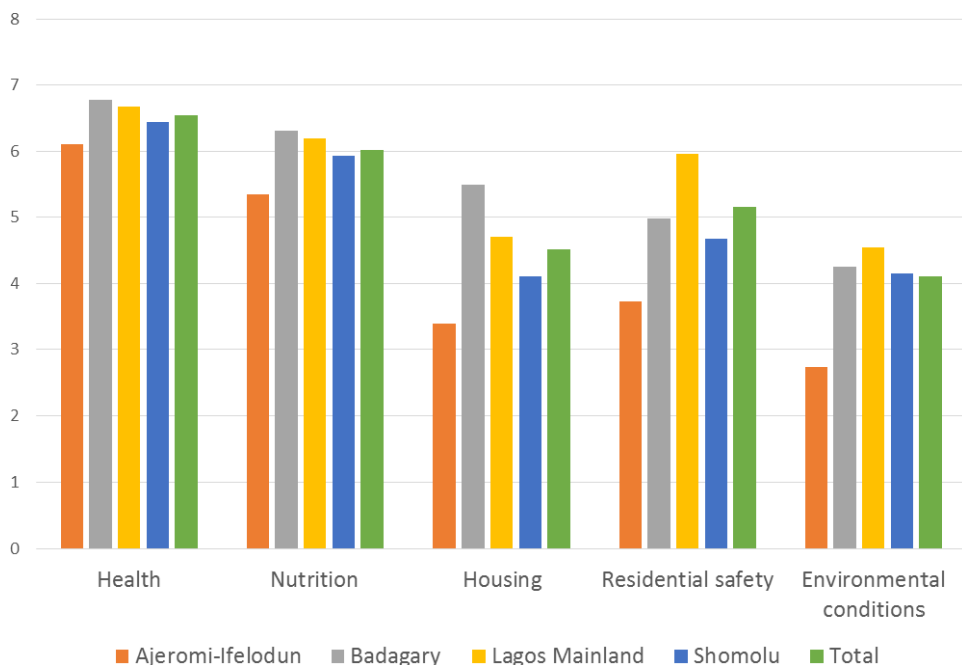


Figure 3. Means of Ratings (10 Very Good, 0 Very Bad) of the Personal and Household (HH) Conditions with Regard to Health, Nutrition, Housing, Residential Safety and Residential Environmental Conditions

Notes: Sample: Health $n = 561$, Nutrition $n = 565$, Housing $n = 563$, Residential safety $n = 562$, Environmental conditions $n = 563$.

areas – especially Ajeromi-Ifelodun and Shomolu. These differences are also statistically relevant according to the Scheffe-test. This test shows that the differences in susceptibility between Ajeromi-Ifelodun and Badagary (0.02) as well as with Lagos Mainland (0.00) and with Shomolu (0.03) are significant. However, the differences between Badagary and Lagos Mainland, as well as between Badagary and Shomolu and between Lagos Mainland compared to Badagary and Shomolu were not significant statistically. In summary, this means that differences in the level of vulnerability can be primarily identified between Ajeromi-Ifelodun and the other three case study locations.

Examining the individual variables by neighborhood helps to explain the calculated aggregate differences in susceptibility. The findings show interesting differences between the case study locations particularly in terms of housing conditions, residential safety and environmental conditions, while in terms of the health conditions solely minor differences can be identified between judgements of households in the various Local Governance Areas surveyed. Mean neighborhood

values rank between 6.1 and 6.78. The statistical validation method of the Scheffe test (Norris *et al.* 2013) indicates that there are no significant statistical differences in health ratings across all four LGAs. With regard to nutritional status, some significant differences are revealed. While households in Badagary and Lagos Mainland ranked their nutritional situation with a mean of 6.19 and 6.31 the situation in Ajeromi-Ifelodun seems to be worse with a mean value of 5.35. Lower values indicate more problematic conditions, while high values show less troubling conditions based on the self-ranking of households.

In terms of housing quality and residential safety, significant differences between the locations become evident. The situation in Ajeromi-Ifelodun is significantly worse compared to Badagary and Lagos Mainland (see Figure 3). The Scheffe test confirms that these differences between Ajeromi-Ifelodun and Badagary are statistically significant as well as the differences between the two locations and Lagos Mainland. However, no significant differences exist between Shomolu and Ajeromi-Ifelodun meaning that the housing situation or housing quality conditions based on the self-evaluation are more or less similar in both areas.

The assessment of the residential safety of the neighborhoods shows that Ajeromi-Ifelodun has the lowest value with a mean of 3.73 meaning that the overall safety situation perceived by the interviewed household is rather bad and problematic. Even though the value in Badagary with 4.98 also hints toward deficits in terms of the safety of the residential areas there, it is— however - significantly higher compared to Ajeromi-Ifelodun. Particularly, the inhabitants interviewed in Lagos Mainland have in general evaluated their safety situation to be more positive compared to all other locations. The Scheffe test confirms that differences between Ajeromi-Ifelodun and Badagary as well as Lagos Mainland are also statistically significant. That means we find the most problematic safety conditions of residential areas in Ajeromi-Ifelodun and Shomolu, whereas the situation based on the self-evaluation of the situation in Lagos Mainland and Badagary seems to be better in relative terms.

The self-evaluation of the environmental conditions and qualities between the four case studies also reveals significant differences. Major differences can particularly be identified between Ajeromi-Ifelodun and the other three case study areas, namely Shomolu, Badagary and Lagos Mainland. The validation with the Scheffe test confirms that the differences identified are also statistically significant.

Self-evaluations by households can encompass a bias in some cases however, we assume that the ranking and particularly the significant differences confirmed by the Scheffe test in terms of the mean values for the different locations provide a first reliable information layer about the differential level of susceptibility in the four LGAs. The rankings in terms of health and nutrition status, safety and crime

as well as environmental conditions within the LGAs based on the household interviews are first proxies that help to assess the differential vulnerability of people in medium and low-income areas in Lagos exposed to natural hazards and adverse event.

3.2. Importance of different natural hazards

Next to the ranking of the living conditions of households and their susceptibility discussed above, we aimed to better understand the importance of various natural hazards for the households interviewed. In this regard households were asked to rank the importance of different hazards, such as rainfall flooding and waterlogging, coastal flooding, heat stress and high temperatures. The results shown in Figure 4 underscore that various households view natural hazards as not important for them. Among the natural hazards that are seen as relevant it is particularly rainfall flooding and waterlogging that most of the households view as most important.

Interestingly, heat stress seems to be a hazard that is highly relevant for many households interviewed in the selected case study locations in Lagos

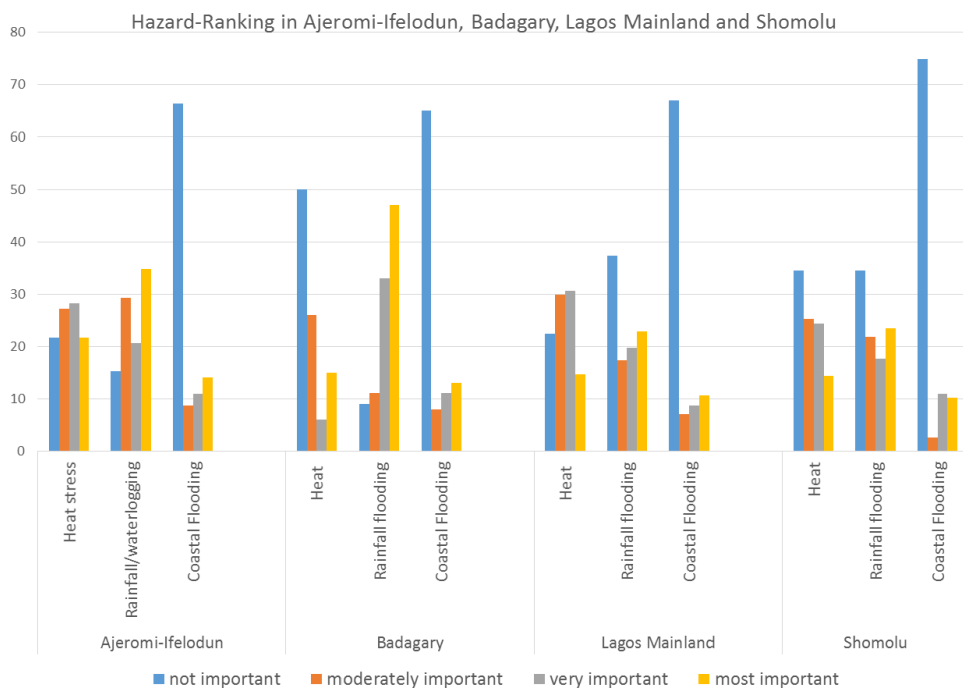


Figure 4. Ranking of the Importance of Different Natural Hazards (Answers in Percentage of Respondents)

Notes: Sample: Heat stress $n = 557$, Rainfall/waterlogging $n = 557$, Coastal Flooding $n = 556$.

(see Figure 4). This supports the findings of Ajibade et al. (2016) that shows city experts rank heat stress as a priority with existing city action lagging behind risk. In contrast, coastal flooding has a lower priority even though some of the districts are located on the coast. Consequently, households in the survey locations view quite opposite phenomena, namely heat stress and high temperatures on one hand and waterlogging and rainfall flooding on the other, as important hazards. Coastal flooding is not an issue at least is not perceived as important as the other two hazards.

3.3. Ranking of exposure

Beside the evaluation of the importance of selected natural hazards (Figure 4), we examined how households perceive their own exposure to hazards outlined before — namely heat stress/high temperatures, rainfall flooding/waterlogging and coastal flooding. The ranking of exposure to rainfall flooding/waterlogging was used since many households see rainfall flooding and waterlogging as a problem. The analysis reveals that the highest mean value of the households interviewed is shown for the case study area Badagary, followed by Ajeromi-Ifelodun and thereafter the other three case study areas with a nearly similar value (see Figure 5).

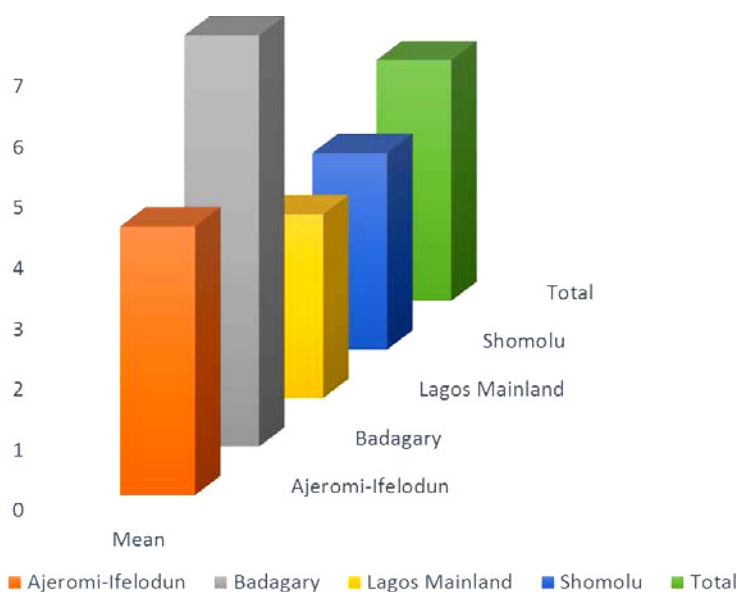


Figure 5. Ranking of Exposure to Flooding

Notes: Sample: $n = 563$.

The difference between Ajeromi-Ifelodun and Badagary is significant and also the differences in terms of perceived exposure between Ajeromi-Ifelodun and Lagos Mainland. The statistical validation based on the Scheffe test underscores that the differences observed between Lagos Mainland and Badagary are statistically significant. That means that even though the exposure to rainfall flooding and waterlogging is perceived by interviewed households to be higher in Badagary compared to Ajeromi-Ifelodun the susceptibility level of people is more problematic in Ajeromi-Ifelodun compared to Badagary. Interestingly, the lowest exposure level is shown for Lagos Mainland and this area also shows the best values in terms of the assessed safety of the residential area based on the self-assessment of the households (see Figures 4 and 5). Overall, households in Badagary rate their own exposure to flooding and waterlogging higher compared to all other case study locations. This correlates with a ranking of flooding as the most important hazard in this location compared to all other case study sites (see Figure 4).

3.4. Behavior change in the context of extreme events

Shifts in households risk management regimes can be used as proxies for transformations at the household level. We examined whether households interviewed in the four case study areas have changed their behavior in the context of extreme and hazardous events in Lagos. Interestingly, the survey shows that the majority of the respondents indicated that no change of behavior was undertaken after extreme events (see Figure 6). However, in some locations a significant proportion of households — for example in Badagary about 40% — reported that they had

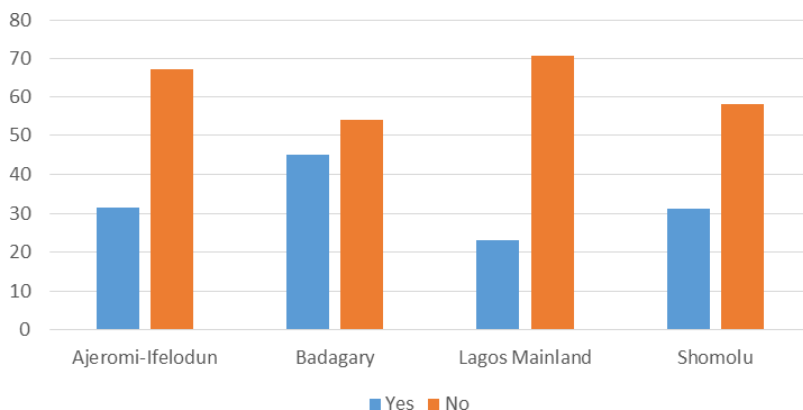


Figure 6. Behavior Change After a Hazardous Event (in Percentage)

undertaken changes in their risk management strategies and actions through behavioral change. The number and the percentage of households that reported that they have undertaken behavior change differs significantly between the areas examined. While in Badagry the percentage is quite significant with more than 40% of the respondents that answered the questions, the percentage of those who indicated that they have modified their behavior and risk management strategies in Lagos Mainland is much lower and accounts solely for about 20% of the respondents.

When asking those households that have undertaken changes in their behavior after extreme events regarding their reasons for these changes, we found that in all locations experienced damage was an important trigger for behavioral changes followed by the recommendations of friends. Much fewer households said that changes of behavior were due to recommendations by local governments or due to injured household members (see Figure 7). This indicates a failure of risk management to reach out and support those at risk and recently impacted. Further work could usefully explore the reasons for this gap.

Furthermore, we explored which measures households have taken in the context of behavior change and their risk management strategies. About 34% of the respondents in Ajeromi-Ifelodun said that concrete changes encompassed improvements of the house, followed by activities undertaken jointly with neighbors to strengthen resilience. Approximately 13% of the households

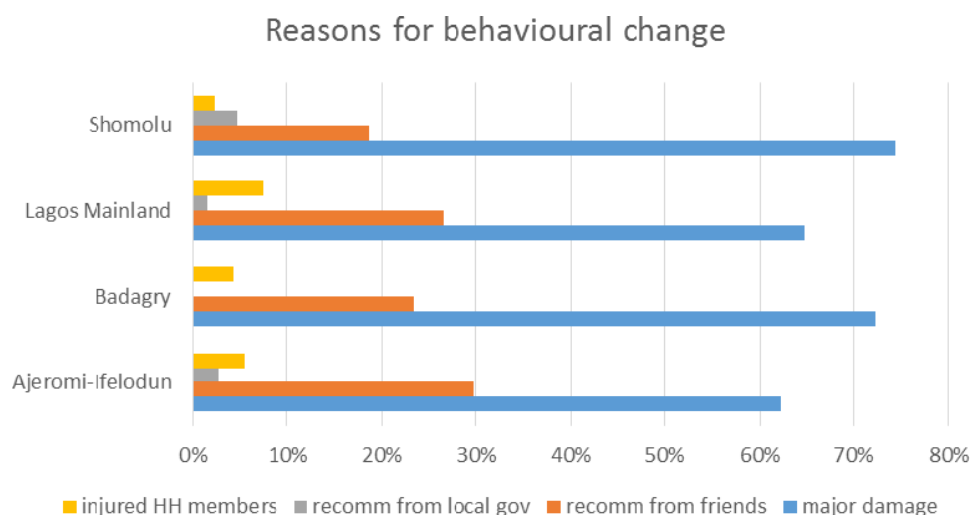


Figure 7. Reasons for Behavior Change after a Hazardous Event

Notes: Sample: $n = 195$.

interviewed answered that they had temporarily moved out of the house or residential location. Very few mentioned that behavior changes also included finding additional income sources or eating cheaper food. Similar patterns were revealed in the other case study locations. Most important changes undertaken were improvements of the house or housing situation. Also temporary migration was mentioned by various households as a response measure undertaken after a hazard stroke.

3.5. Preparedness

When asking households about their current feeling of being prepared (or not) most households indicated that they donot feel sufficiently prepared (see Figure 8). That means none of the respondents rated the own preparedness higher than 5.25 (scores between 0 and 10) and some households even said that their level of preparedness is very low — shown with scores between 2 and 3. Overall, the mean value of all answers is 4.06. This means that the perceived preparedness level is mediocre. The differences regarding the judgements about the own preparedness level in the case study locations are significant and underscore that households in Ajeromi-Ifelodun feel less prepared (mean 3.33) compared to households in Lagos Mainland (mean 4.23) and Badagary (mean 4.69). The Scheffe test confirms that the differences between Ajeromi-Ifelodun and Badagary are significant but the differences between Ajeromi-Ifelodun and Lagos Mainland or Shomolu are not significant.

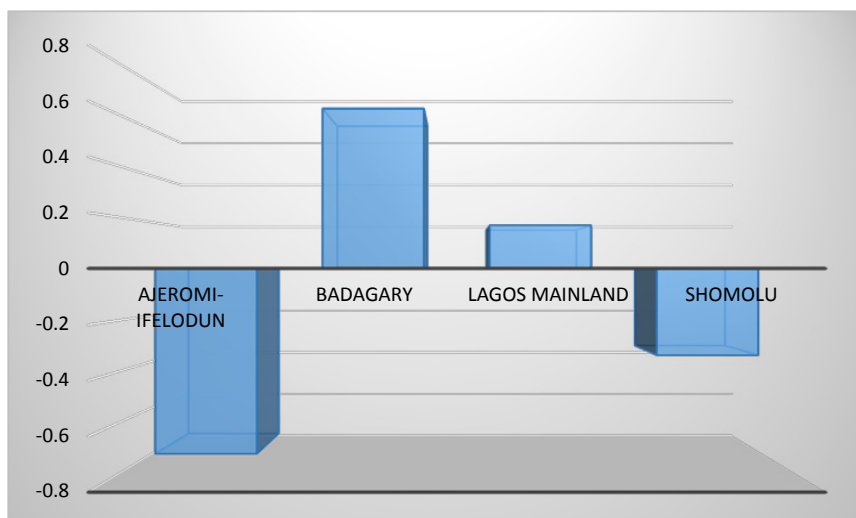


Figure 8. Feeling of Preparedness — Differences from the Mean in the Four Survey Locations
Notes: Sample: $n = 195$.

In addition, the evaluation of actual risk reduction practice in the households confirms such differential capacities between the households in the case study locations. While households in Ajeromi-Ifelodun ranked their risk reduction practice rather low with about 3.24 scores, the households in Lagos Mainland and Badagary ranked their capacities and risk reduction practices with about 4.6 and 4.9 in average. The Scheffe test confirms that the difference between Ajeromi-Ifelodun on one hand and Badagary and Lagos Mainland on the other are significant but no statistically significant differences can be identified between Ajeromi-Ifelodun and Shomolu. In a similar way, the assessment of existing financial resources to recover confirmed the different levels of vulnerability between the case study locations. Interestingly, the rating of support and help from friends does not reveal major differences between the survey locations. The help received from friends was rated with about 3.12 on average.

Next to the evaluation of the individual risk management strategies and support received from social networks, we also examined how different households rate the support received and performance of local government and local government institutions in order to better cope and adapt to extreme events and adverse hazard impacts.

3.6. Rating of support from local government

The ratings regarding the support received from local governmental institutions during and after adverse events shows that none of the four survey locations has a score above 2 in the mean. That means that most households in various locations of the survey perceive the performance level of local governmental institutions in terms of providing support after an extreme or hazardous event as rather weak and poor with ratings between 1.09 in Ajeromi-Ifelodun and 1.88 in Shomolu. The Scheffe test indicates that no significant differences can be found in terms of the answers and scores between the case study locations. This is also true for the access to early warning information, which is rated a bit better with about 2.76 scores on average, but which still shows a low level of performance or perceived performance.

Also the evaluation of the actions by the local government and governmental institutions over the past 10 years confirms that overall most households rank these actions and related improvements with low performance value of about 2.53 scores as the mean. However, the analysis of the rankings between the case study locations reveals important differences (see Figure 9).

Figure 9 shows that households in Lagos Mainland evaluate the performance and actions of the local government in the past 10 years in terms of risk reduction more positively compared to Badagary and Ajeromi-Ifelodun. The Scheffe test

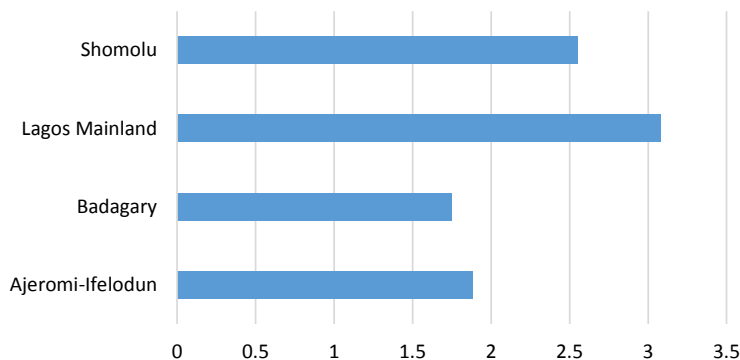


Figure 9. Evaluation of Actions of Local Government Regarding Risk Reduction in the Past 10 Years

Notes: Sample: $n = 195$.

confirms that the differences found between Lagos Mainland and Ajeromi-Ifelodun are statistically significant. Also the Gabriel test confirms this statement.

In the next section, we compare the evaluation of the performance of local governmental institutions in the past 10 years with the perception about the potential performance in the future (next 10 years) by the households interviewed in terms of the level of support in dealing with hazards, e.g., floods. The findings (see Figure 10) show that many households are not sure whether the performance will improve or reduce (see yellow bar chart).

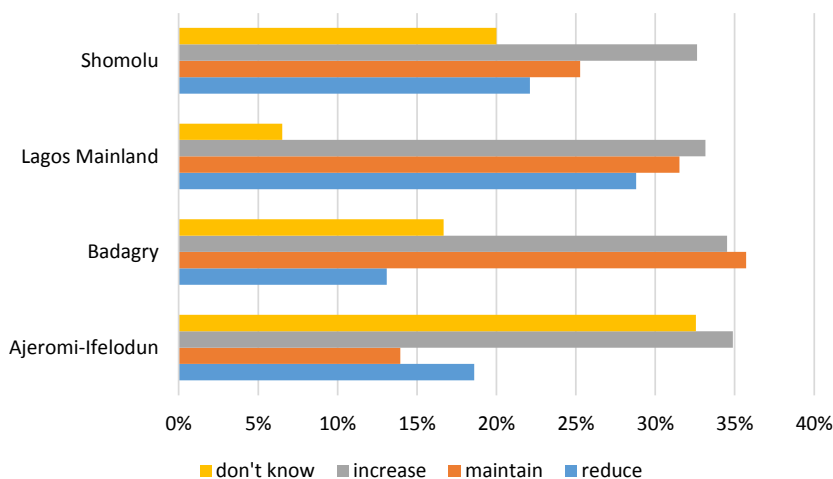


Figure 10. Assumption of the Performance of Local Government Risk Reduction in the Next 10 Years

Notes: Sample: $n = 449$.

At the same time the answers reveal that many households that answered the questions in Ajeromi-Ifelodun and in Shomolu expect that the performance of governmental actions in terms of risk reduction will increase in the future. In contrast, a significant number of people interviewed are also sceptical and particularly in Lagos Mainland about 20% and in Shomolu and Ajeromi-Ifelodun about 18% said that they expect a reduction in the performance of governmental institutions in terms of supporting risk reduction. These differences are difficult to explain, however, they underscore that the assumptions about the future performance of local governmental institutions does not differ that much between the survey locations, but more between the households interviewed within each location. When comparing the expectations about the governmental support in the future, particularly whether government support will increase, will be maintained at the same level or reduce with the HH-income groups, the survey reveals that households with a lower income (first 2 lowest income groups) in tendency think that governmental support will be maintained or even reduce.

These results, however, cannot be statistically validated due to the small size of the sub-groups. Another factor, however, that supports the assumption that household status (e.g., socio-economic capacity) has an influence on the judgements of the level of support of governmental institutions in the future is “education”. Respondents with a relatively low educational level (primary and secondary education) rather assume that the governmental support will be maintained or decrease instead of increase. In contrast, households where the head of the household holds a bachelor or master degree as the highest education completed rather think in tendency that the governmental support will increase (see Figure 11). It has to be mentioned that the group sizes for the different categories are small and therefore no statistical verification can be made. Statistically the relation between educational level and the assumptions about the government performance in the future is

		Government support in the future				Total
		maintain	reduce	Increase	do not know	
Education	1 Primary Education	19.3%	9.9%	8.8%	4.2%	11.1%
	2 Secondary Education	36.1%	46.5%	41.9%	43.1%	41.6%
	3 Polytechnics	21.8%	20.8%	14.9%	23.6%	19.5%
	4 Bachelor	17.6%	16.8%	23.0%	29.2%	21.1%
	5 Master	5.0%	5.9%	11.5%		6.6%
Total		100.0%	100.0%	100.0%	100.0%	100.0%

Figure 11. Cross-Tabulation Between the Highest Educational Level of the Respondent and the Assumed Development of Governmental Support in the Future (q118 education * q72 gov Support Future)

confirmed by cramers $V=0.15$ which is a rather weak correlation. However, the correlation, even though weak, has a significance level of 99%.

4. Discussion and Conclusions

The findings of the household survey provide important information about the living conditions and differential susceptibilities of people exposed in selected locations in Lagos that encompass primarily low and middle income households. The results show how different households view their own risk management capacities and actions in the past and present as well as their perception about the future. The juxtaposition of the evaluation of individual risk management regimes and the perception of the risk management performances of local governmental institutions and official authorities in the past and in the future also highlighted that many households rather view the performance of governmental institutions more negatively compared to their own risk management performance.

The rating of the importance of different hazards often correlates with the ranking of the perceived exposure of the households. This can be inferred to mean that people who have not yet experienced certain hazards view their own exposure in tendency rather low. Hence, motivating households to prepare for not-yet experienced hazards, such as sea-level rise in Lagos, still seems to be a challenge, since most households do not regard these hazards as a major problem.

However, changes in risk management regimes at the household level were also detected. The interviews and the respective data of more than 500 households in the selected case study sites in Lagos revealed that household risk management regimes were modified or changed, particularly if the household had experienced damages due to natural hazards in the past. While some households have undertaken significant modifications of their personal risk management regime, for example in terms of strengthening the structure of the house or even in terms of temporal migration, it is evident that many households have not modified their risk management actions. It is important to note that many households regard the present risk management of local governmental institutions as insufficient and expect that the level of support will be maintained or decrease rather than increase. When examining the educational profile and income structure of these households it became evident that particularly households with a low income (first two income categories) and a low level of education view the performance of risk management of governmental institutions at the local level more negative compared to those with a higher educational level and higher income. Many of the households with a low level of formal education and low income did not undertake any changes in the risk management regime at

their (household) level. Even though the size of the household survey does not allow for further statistical validation, it is likely that on a continuum from positive transformation, preparedness, resistance and collapse, many of these households can be classified as shifting toward categories of not being prepared and even likely to experience partial collapse, if new extreme events and hazards (e.g., sea-level rise) strike or the intensities and frequencies of these phenomena (inland flooding, heat stress) might increase.

In this regard, it is an open question whether conventional strategies to address urban vulnerability such as enforcing urban planning laws, as proposed by Adelekan (2010), would be appropriate. The findings of the household survey indicate to some extent that most vulnerable and poor households with only a basic level of education have limited trust in governmental institutions and therefore evaluate their past and future performance rather negative. Even though Lagos is a relatively wealthy megacity and a major economic hub compared to other urban areas in West Africa, the past urban renewal program seem to have not sufficiently improved slum and low income areas and might have privileged specific other neighborhoods.

For example, the significant differences between the performance evaluation of governmental institutions in terms of their risk management support along the four case study areas show that households in Lagos Mainland seem to have — in part — benefited from past actions, while the very low values in Badagary and Ajeromi-Ifelodun show that many households in these areas seem to have been left out of this support or do not perceive it as effective. Against this background it is a bit surprising that various households in Ajeromi-Ifelodun compared to the other case study areas assume that governmental risk management performance will increase or be maintained in the future.

Even though many households have not changed their own risk management regime, it is a positive sign that many households, which experienced damages in the past, changed their risk management behavior. Hence, another scenario might emerge in the future where households that will experience extreme events — once impacted — undertake changes and transformations in their risk management regime rapidly. These findings represent an important difference to the majority of published works on low income at risk populations. Here works has tended to focus on successful examples of community-based risk management either in collaboration with government or filling gaps where government is inactive. The current study shows a more common place, but less frequently described situation where there is a negative overlapping of government and household inaction.

Overall, the household survey underscores the heterogeneity of perceptions and behavioral changes at the micro scale (household level). While experienced damage due to extreme events and hazards seems to be a major trigger for

households to change their behavior, the survey also revealed that the evaluation of the risk management performance by local governmental institutions is perceived quite differently dependent on the educational level and income level of the household interviewed. Particularly those households that are marginalized in terms of the low level of education and income rather do not expect much from the government at present and in the future. In contrast households with higher income (higher medium income categories) and higher educational degrees in tendency assume that local governmental risk management will improve in the future. Even though it still is open whether local governmental risk management performance will increase or decrease in the next 10 years, it is important to acknowledge that those who are particularly marginalized might need to be addressed differently in the future by risk management strategies and development policies due to their more negative and critical judgements and opinions that might also indicate a lack of trust in governmental institutions in general.

In this regard, the assessment and evaluation of factors that make people more prone to be negatively affected by extreme events (Fig. 3), such as precarious housing conditions, environmental problems in the neighborhood and a low residential safety are areas where risk management and urban development need to act jointly. Solely integrated strategies that link governmental disaster risk reduction and risk management (early warning, preparedness, etc.), climate change adaptation and broader strategies of urban development/urban renewal (urban and spatial planning) with specific household risk management strategies can be effective. The improved understanding of various risk management regimes at the household level and the identification of changes and transformation processes within these regimes are important prerequisites for such efforts.

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